

What is claimed is:

1 1. A thermal barrier coating composition comprising 46-97 molar  
2 percent base oxide, 2-25 molar percent primary stabilizer, 0.5-  
3 25 molar percent group A dopant, and 0.5-25 molar percent group  
4 B dopant, said base oxide being selected from the group  
5 consisting of  $ZrO_2$ ,  $HfO_2$  and combinations thereof, said primary  
6 stabilizer being selected from the group consisting of  $Y_2O_3$ ,  
7  $Dy_2O_3$ , and  $Er_2O_3$  and combinations thereof, said group A dopant  
8 being selected from the group consisting of rare earth oxides,  
9 alkaline earth metal oxides, transition metal oxides and  
10 combinations thereof, and said group B dopant being selected  
11 from the group consisting of  $Nd_2O_3$ ,  $Sm_2O_3$ ,  $Gd_2O_3$ ,  $Eu_2O_3$  and  
12 combinations there.

1 2. A thermal barrier coating composition according to claim 1,  
2 wherein the group A dopant is selected from the group consisting  
3 of  $Sc_2O_3$ ,  $Yb_2O_3$ ,  $MgO$ ,  $NiO$ ,  $Cr_2O_3$ ,  $CoO$ ,  $Fe_2O_3$ ,  $TiO_2$ ,  $RuO_2$ ,  $Ta_2O_5$ , and  
4 combinations thereof.

1 3. A thermal barrier coating composition according to claim 1,  
2 wherein the group A dopant and the group B dopant are present in  
3 the composition in substantially equal molar percentages.

1 4. A thermal barrier coating composition according to claim 1,  
2 wherein the ratio of the molar percentages of group A dopant to  
3 group B dopant is between about 1:8 and 8:1.

1 5. A thermal barrier coating composition according to claim 1,  
2 wherein the ratio of the molar percentage of the primary  
3 stabilizer to the sum of the molar percentages of the Group A  
4 dopant and the Group B dopant is between 1:1 and 10:1.

1 6. A thermal barrier coating composition according to claim 1,  
2 wherein the ionic radius of the group A dopant cation is smaller  
3 than the ionic radius of the primary stabilizer oxide cation or  
4 the base oxide cation.

1 7. A thermal barrier coating composition according to claim 1,  
2 wherein the ionic radius of the group B dopant cation is larger  
3 than the ionic radius of the primary stabilizer oxide cation or  
4 the base oxide cation.

1 8. A thermal barrier coating composition comprising 46-97 molar  
2 percent base oxide, 2-25 molar percent primary stabilizer, 0.5-  
3 12.5 molar percent group A dopant, and 0.5-12.5 molar percent  
4 group B dopant, said base oxide being selected from the group  
5 consisting of  $ZrO_2$ ,  $HfO_2$  and combinations thereof, said primary  
6 stabilizer being selected from the group consisting of  $Y_2O_3$ ,  
7  $Dy_2O_3$ , and  $Er_2O_3$  and combinations thereof, said group A dopant  
8 being selected from the group consisting of rare earth oxides,  
9 alkaline earth metal oxides, transition metal oxides and  
10 combinations thereof, and said group B dopant being selected  
11 from the group consisting of  $Nd_2O_3$ ,  $Sm_2O_3$ ,  $Gd_2O_3$ ,  $Eu_2O_3$  and  
12 combinations thereof.

*can be rare earth*

1 9. A thermal barrier coating composition according to claim 8,  
2 wherein the group A dopant is selected from the group consisting  
3 of  $\text{Sc}_2\text{O}_3$ ,  $\text{Yb}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{NiO}$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{CoO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{RuO}_2$ ,  $\text{Ta}_2\text{O}_5$ , and  
4 combinations thereof.

1 10. A thermal barrier coating composition according to claim 8,  
2 wherein the group A dopant and the group B dopant are present in  
3 the composition in substantially equal molar percentages.

1 11. A thermal barrier coating composition according to claim 8,  
2 wherein the ratio of the molar percentages of group A dopant to  
3 group B dopant is between about 1:8 and 8:1.

1 12. A thermal barrier coating composition according to claim 8,  
2 wherein the ratio of the molar percentage of the primary  
3 stabilizer to the sum of the molar percentages of the Group A  
4 dopant and the Group B dopant is between 1:1 and 10:1.

1 13. A thermal barrier coating composition according to claim 8,  
2 wherein the ionic radius of the group A dopant cation is smaller  
3 than the ionic radius of the primary stabilizer oxide cation or  
4 the base oxide cation.

1 14. A thermal barrier coating composition according to claim 8,  
2 wherein the ionic radius of the group B dopant cation is larger  
3 than the ionic radius of the primary stabilizer oxide cation or  
4 the base oxide cation.

1 15. A thermal barrier coating composition according to claim 8,  
2 wherein the ionic radius of the group A dopant cation is smaller  
3 than the ionic radius of the primary stabilizer oxide cation or  
4 the base oxide cation, and the ionic radius of the group B  
5 dopant cation is larger than the ionic radius of the primary  
6 stabilizer oxide cation or the base oxide cation.

1 16. A thermal barrier coating composition comprising 46-97  
2 molar percent base oxide, 2-25 molar percent primary stabilizer,  
3 and 0.5-25 molar percent of a compound selected from the group  
4 consisting of group A dopants and group B dopants, said base  
5 oxide being selected from the group consisting of  $ZrO_2$ ,  $HfO_2$  and  
6 combinations thereof, said primary stabilizer being selected  
7 from the group consisting of  $Y_2O_3$ ,  $Dy_2O_3$ , and combinations  
8 thereof, said group A dopant, if present, being selected from  
9 the group consisting of rare earth oxides other than  $Er_2O_3$ ,  
10 alkaline earth metal oxides, transition metal oxides and  
11 combinations thereof, and said group B dopant, if present, being  
12 selected from the group consisting of  $Nd_2O_3$ ,  $Sm_2O_3$ ,  $Gd_2O_3$ ,  $Eu_2O_3$   
13 and combinations thereof.

1 17. A thermal barrier coating composition according to claim  
2 16, wherein the group A dopant, if present, is selected from the  
3 group consisting of  $Yb_2O_3$ ,  $Sc_2O_3$ ,  $MgO$ ,  $NiO$ ,  $Cr_2O_3$ ,  $CoO$ ,  $Fe_2O_3$ ,  
4  $TiO_2$ , and  $RuO_2$ .

1 18. A thermal barrier coating composition according to claim  
2 16, wherein the ionic radius of the group A dopant cation, if  
3 present, is smaller than the ionic radius of the primary  
4 stabilizer oxide cation or the base oxide cation.

1 19. A thermal barrier coating composition according to claim  
2 16, wherein the ionic radius of the group B dopant cation, if  
3 present, is larger than the ionic radius of the primary  
4 stabilizer oxide cation or the base oxide cation.

1 20. A thermal barrier coating composition according to claim  
2 16, wherein the ratio of the molar percentage of the primary  
3 stabilizer to the molar percentage of the Group A dopant or the  
4 Group B dopant is between 1:1 and 10:1.